REVENDICATIONS

1 – Procédé de commande du répandage de gravillons et de liant sur une chaussée (C) du genre apte à réaliser le recouvrement, par lesdits gravillons, du liant répandu sur ladite chaussée et ce indépendamment de l'angle d'inclinaison (A), par rapport à l'horizontale (H) dans le sens transversal de la chaussée, du châssis (1) de l'engin mobile porteur de l'unité de distribution de gravillons pourvue d'une pluralité de trappes (2) et de la rampe de distribution de liant (3) pourvue d'une pluralité de diffuseurs (4) et maintenue parallèle à la chaussée par des moyens appropriés ;
caractérisé en ce qu'il consiste, de manière automatique :
a) à déterminer l'angle d'inclinaison (A) dudit châssis (1) au moyen d'un dispositif, du type inclinomètre (5), adapté pour générer un signal dont la valeur est proportionnelle audit angle ;
b) à transmettre ledit signal à un calculateur adapté pour l'interpréter et générer les commandes aptes, selon le mode opératoire retenu, à ouvrir ou fermer les trappes (2) de l'unité de gravillons et/ou les diffuseurs (4) de la rampe de distribution de liant (3) et/ou à déplacer latéralement ladite rampe (3) de manière à obtenir le meilleur recouvrement possible du liant (6) par les gravillons (7).

2 – Dispositif pour la mise en œuvre du procédé selon la revendication 1, caractérisé en ce que l'inclinomètre (5) comporte une électronique associée adaptée pour fournir un signal brut (SB) variant dans une plage de valeurs de tensions bien déterminées proportionnelles à son inclinaison.

3 – Dispositif, selon la revendication 2, caractérisé en ce que le signal brut (SB), fourni par l'électronique associée à l'inclinomètre (5), est transmis à un circuit électronique (8) de traitement du signal qui comporte un filtre (9) adapté pour absorber les vibrations et les accélérations-décélérations de l'engin mobile et un convertisseur (10) adapté pour définir, au milieu de la plage des valeurs de tension, un point de référence correspondant à la position horizontale de manière à connaître le sens de dévers gauche ou droite du châssis (1) dudit engin mobile par rapport audit point de référence, le signal (ST) ainsi traité étant transmis au calculateur.

4 – Dispositif, selon la revendication 2 ou la revendication 3, caractérisé en ce que l'inclinomètre (5) et son électronique de traitement (8) sont solidaires du châssis (1) de l'engin mobile.

5 - Dispositif, selon la revendication 2, caractérisé en ce que la rampe de distribution de liant (3) comporte un inclinomètre adapté, en liaison avec l'inclinomètre (5) du châssis (1) et via le calculateur, pour maintenir automatiquement ladite rampe parallèle à la chaussée.

6 – Dispositif, selon la revendication 5, caractérisé en ce que la distance de la rampe (3) à la chaussée (C) est déterminée par un capteur situé sur son axe de symétrie.

7 - Dispositif, selon l'une quelconque des revendications 2 à 6, caractérisé en ce que le calculateur est situé dans la cabine de l'engin mobile et comporte des moyens visualisant les trappes (2) et/ou les diffuseurs (4) en fonctionnement et/ou la position de la rampe de distribution de liant (3) par rapport à sa position de référence.

8 - Dispositif, selon la revendication 2, caractérisé en ce que la rampe de distribution de liant (3) est associée à un capteur de déplacement donnant, au calculateur, la position de celle-ci à chaque instant.

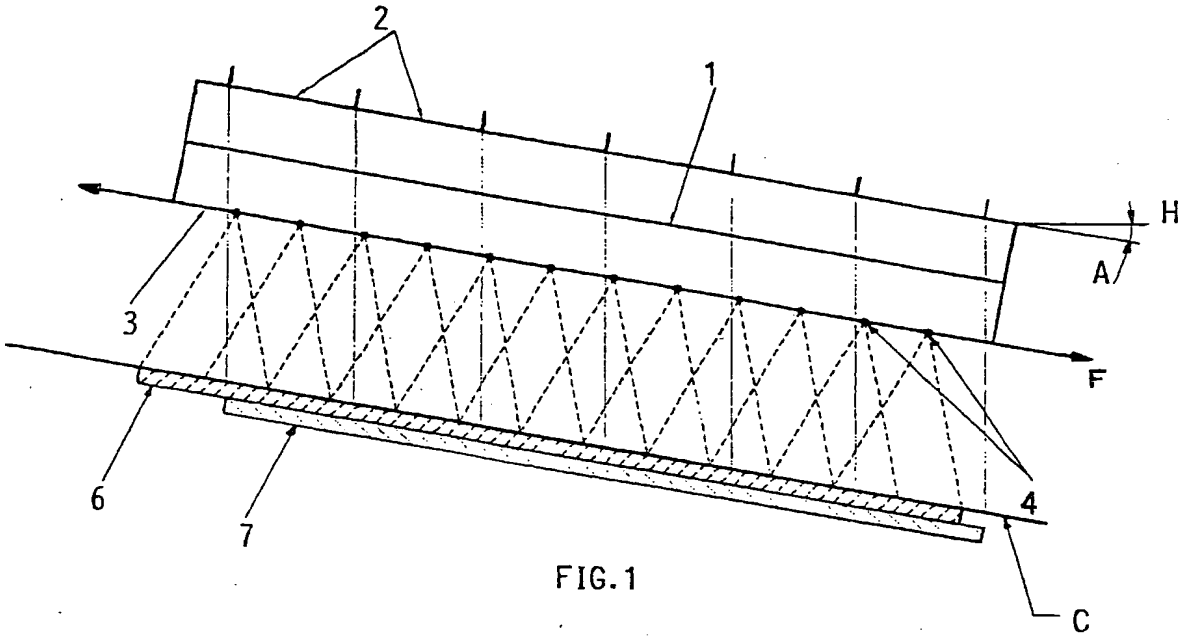

FIG.1

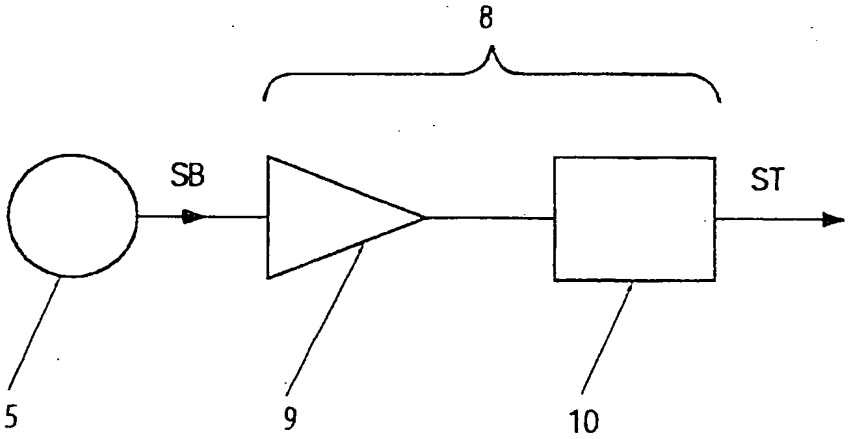

FIG.2

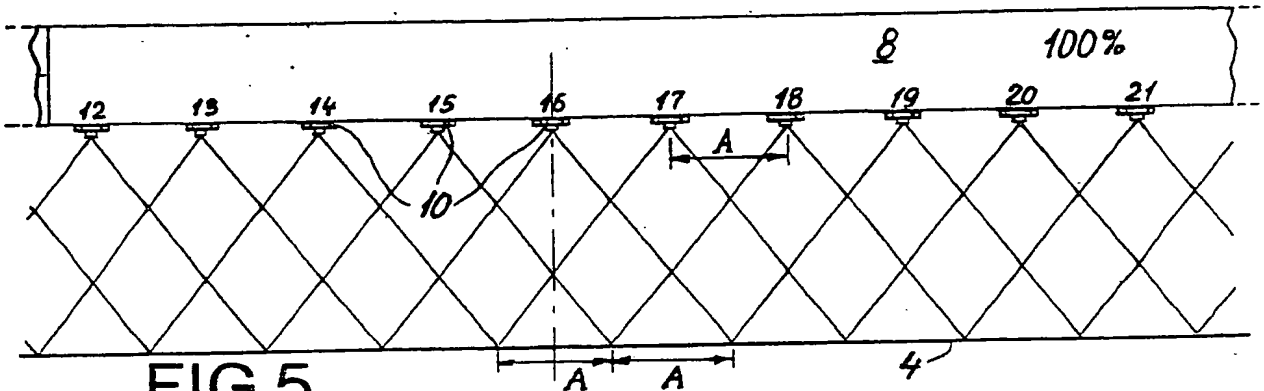

FIG.5

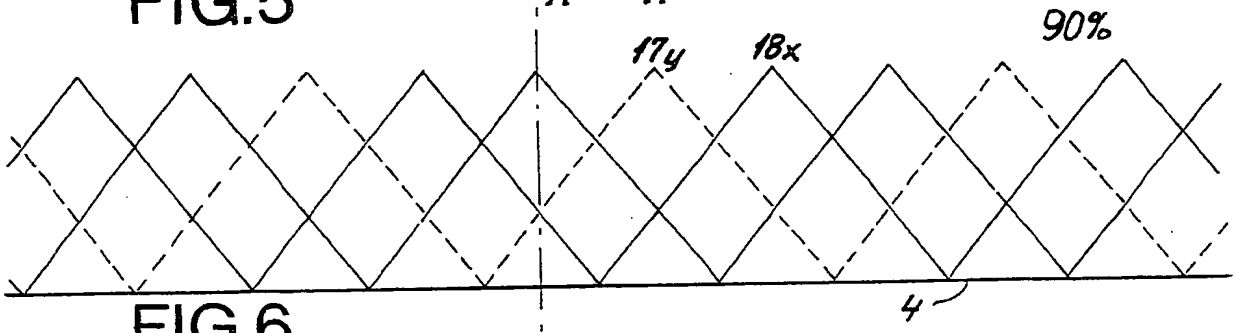

FIG.6

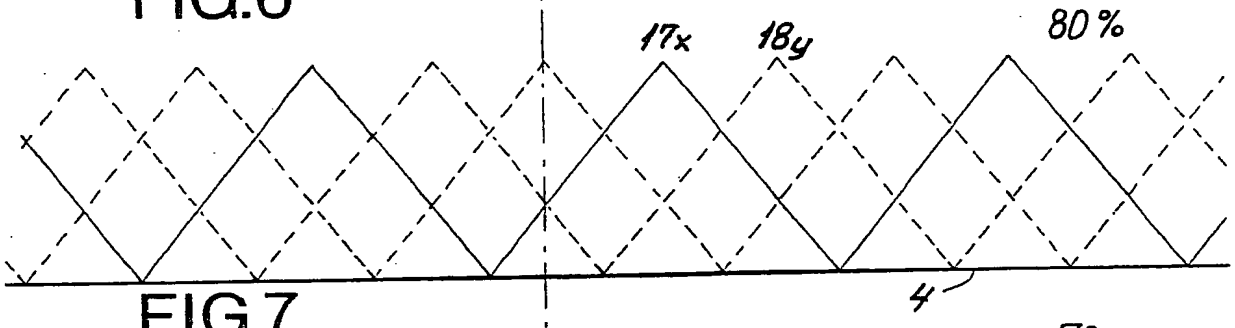

FIG.7

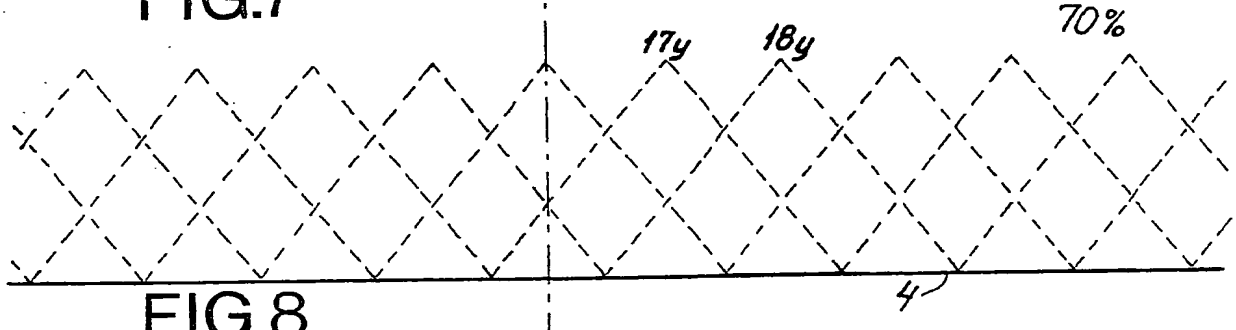

FIG.8

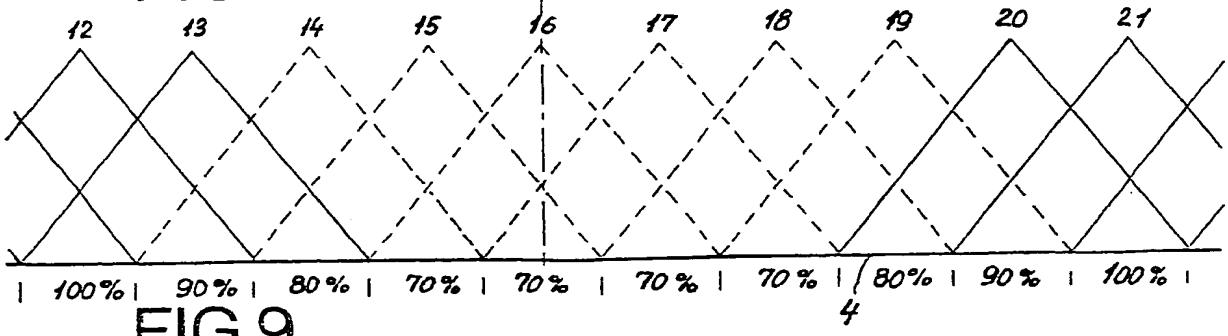

FIG.9

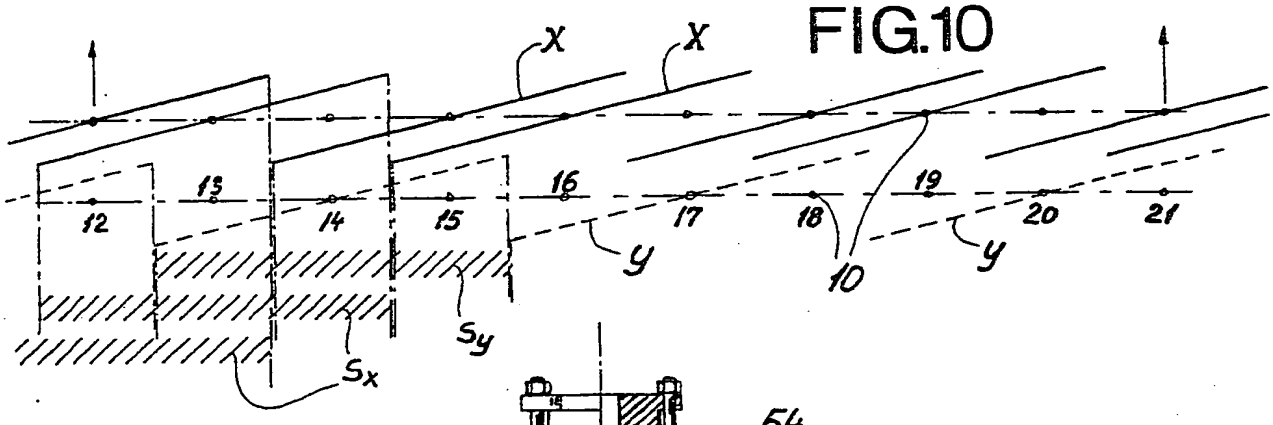

FIG.10

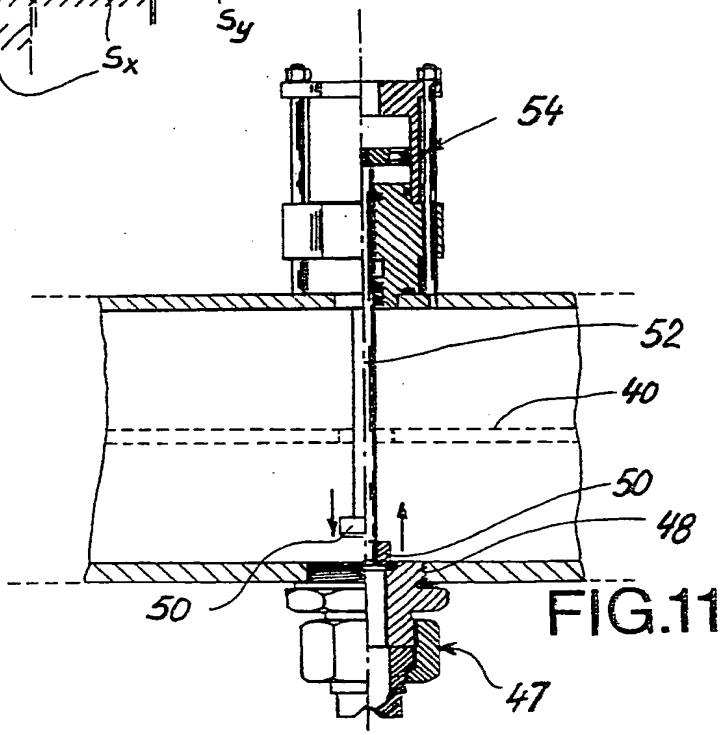

FIG.11

SPECIFICATION

A method and a device for dosing a binder liquid to a road surface

The present invention relates to a method of supplying a binder liquid to a road surface preparatory to the surface being provided with a top layer aggregate such as crushed stone. In this type of road maintenance work it is important that the liquid bituminous binder be supplied and distributed rather accurately, according to actual requirements as set by the condition of the former road surface, both generally and with respect to varying requirements throughout the width or cross profile of the road, all as explained in more detail in the international Patent Application No. PCT/SE80/00020.

The liquid binder is applied to the road surface by means of a spray boom which is provided with a row of spray nozzles and is moved forward in a cross position above the road such that the binder is applied to the road surface in a coherent layer by virtue of the overlapping character of the road stripe areas as having received the binder from the single spray nozzles. Principally it is perfectly possible to make the spraying capacity of the single nozzles adjustable, whereby both the general dosage and the differentiated cross profile may be adjusted as required, but in practice such an individual capacity adjustment is very difficult to achieve in any simple and reliable manner.

Thus, more specifically the invention relates to a method as specified in the introductory clause of claim 1, and it is the purpose of the invention to provide such a method, which will enable the adjustable dosage of the binder to be effected in a simple and reliable manner.

This, according to the invention, is achieved by carrying out the method as specified in the characterizing clause of claim 1, i.e. with the use of a relatively high number of nozzles operated to work with a considerable degree of overlapping. Of course, the use of many nozzles is a complication, but this complication is by far compensated by the fact that the nozzles need not be really adjustable as to their capacity, since they can be adjustable merely by on/off operation, whereby it can be selected whether in any given area the binder should be applied with high or low capacity. The on/off control of the nozzles is effectively achievable by very simple control means, and these will be perfectly suitable for remote control, of electrical, pneumatical or other nature. Hereby it will even be easily possible for the operator to change the setting of the nozzles during the work, e.g. when the cross profile of the road is known to require a changed distribution of the binder.

In practice the dosage requirements will not be extremely varying throughout the length of the spray boom. By way of example it may be sufficient that the minimum dosage is some 70% of the maximum dosage. It is a special possibility, therefore, that use is made of only two parallel rows of nozzles, one having high capacity nozzles and the other having low capacity nozzles, such that at any place maximum or minimum dosage can be effected by actuating the nozzles selectively, either alternatively or in an additive/non-additive manner.

When the binder is applied with a considerable overlapping between the parallel binder stripes as left on the road by the various neighboring nozzles, then a further adjustment possibility will reside in controlling the said high and low capacity nozzles in such a manner that the said stripes will contain a mixed output from both types of nozzles, whereby the dosage at any place may be graduated further than corresponding just to either high capacity or low capacity dosage.

The invention also comprises a device for dosing out the binder liquid in accordance with the above method.

A preferred embodiment of this device comprises a spray boom provided with two parallel rows of nozzles, of which those in a first row are operable to be shifted on/off-wise between a closed position and a position of maximum output, while the nozzles in the other row are correspondingly shiftable between a closed position and a fully open position, in which their output is somewhat less than said maximum output.

In connection with outlet nozzles which are merely shiftable between a closed and an open position it should be taken into account that the outlet capacity of the nozzles will be dependent of the medium pressure as existing at the supply side of the nozzles. For achieving an accurate rate of supply of the binder liquid to the road surface, therefore, it should be ensured that the supply pressure on the nozzles be kept constant irrespectively of the rate of medium delivery through the nozzles. Such a constancy will be obtainable with the use of a pressure sensor which controls the operation of a pump as supplying the medium to a supply channel in the spray boom from which all the nozzles are branched off. According to the invention, however, a similar control may be effected in a better way by means of a control unit which is automatically informed of the number of open and closed nozzles of high and low outlet capacity respectively, and is operable to hereby control a medium pump to discharge the medium to the nozzles system at a rate corresponding to the desired rate as discharged through the nozzles, thus maintaining the pressure on the nozzle inlet side substantially or fully constant. Both the high and the low capacity nozzles, therefore, can be mounted on the same binder supply channel, when they show the desired difference in size, and they may be designed to work with a binder spreading angle which is the same for both types, whereby, as will be clear from the following, the dosage is controllable in a graduated and accurate manner.

In the following the invention is described in more detail with reference to the drawings, in which:

Fig. 1 is a rear view of a spreader device

according to the invention,

Fig. 2 is a perspective view of an outer section of the spray b om thereof,

Figs. 3 and 4 are plan views of the boom,

Figs. 5—9 are schematic views illustrating different dosing situations,

Fig. 10 is a schematic view of the distribution pattern of the binder on the road surface, and

Fig. 11 is a lateral view, partly in section, of one of the nozzles on the spray boom.

In Fig. 1 is shown a vehicle 2 on a road surface 4, which is to be provided with a new top layer of crushed stone material. Preparatory to the laying out of this layer a layer of a liquid bituminous binder should be applied to the road, and to this end the vehicle 2 is equipped with a tank 6 and a transverse spreader boom 8 having a plurality of spray nozzles 10 mounted and designed so as to each spray down a flat fan of binder onto the road. As shown in Figs. 2 and 3 the nozzles are arranged in two parallel rows, in which the nozzles 10 are designated X and Y respectively. The nozzles are oriented such that the flat binder fans will hit the road in respective, almost linear areas as designated x and y in Fig. 10, these areas being angularly offset from the boom direction such that the liquid fans from adjacent nozzles do not interfere with each other, while on the other hand leaving stripes S and S_y behind them, which are largely overlapping.

The boom 8 is hollow and receives the liquid from the tank 6 through a pump 24, a selector valve 26 and a pair of central hoses 28 (Figs. 1 and 3). The opposed outer portions 30 of the boom are separate hollow members which are hinged to the central boom part by hinges 32 which enable the outer portions 30 to be pivoted and folded horizontally. Across each hinge 32 is provided a supply hose connection 34 between an outlet 36 from the central boom portion and an inlet 38 near the top of the outer portion 30, above a horizontal middle partition 40 therein. At its outermost end the partition 40 is spaced from the boom end such that the liquid can pass into the lower channel part of the boom portion, underneath the partition 40, as shown by an arrow a, and from an outlet opening 42 at the other end of this channel the liquid may be recirculated through a hose 44 to the tank or the pump through the valve 26. A special conduit 46 is arranged for emptying the boom by suction.

Each of the nozzles is designed as shown in Fig. 11. It comprises a nozzles member 46 screwed into a hole 48 in the bottom side of the boom 8 and having an interior inlet opening which cooperates with a stopper 50 on a piston rod 52 of an upper air cylinder 54. All of the cylinders 54 are connected through thin control hoses (not shown) to a control unit 56 (Fig. 1), from which the various cylinders are individually controllable for on/off actuation of the associated nozzles.

The pump 24 is a positive displacement pump which is controlled by the control unit such that its output is adjusted to suit the requirements as given by the number and sizes of the nozzles as actually kept open, whereby the liquid pressure inside the boom will be kept constant irr spective of variations of the total nozzles output. In other words the outlet capacity of the single select d nozzles will be independent of opening and closing of other nozzles.

The bituminous binder should be handled in warm conditions, and the partition 40 in the outer boom portions 30 serve to guide the binder flow to minimize the cooling at the outer boom ends.

In Figs. 5—9 the numerals 12—21 designate the nozzles positions along the boom and are indicative of both X-nozzles and Y-nozzles. The spreading fans are marked by full lines for X-nozzles and by dotted lines for Y-nozzles. Thus, in Fig. 5, all X-nozzles are actuated and all Y-nozzles are closed. The distance between the nozzles along the boom is marked A, and it will be noticed that the spreading angle of the fans and the height of the boom above the road surface are so adapted that any road sub area will be hit by the liquid as supplied from three consecutive nozzles, the overlapping of the fans from two neighboring nozzles being 2A.

The dosage as effected in Fig. 5 is designated "100%", corresponding to actuation of all X-nozzles. Fig. 8 shows a corresponding situation, in which all Y-nozzles are actuated, and the dosage now amounts to "70%", as generally the capacity of the Y-nozzles is 70% of that of the X-nozzles.

It would be possible to provide for a dosage of "170%" by actuating both the X- and the Y-nozzles, but in practice it is preferred and sufficient to use them alternatively only. A dosage of 70% and 100%, respectively, could even be achieved by means of a row of X-nozzles of "70%" capacity and a row of Y-nozzles of "30%" capacity, whereby 100% was produceable by combined actuation of both types of nozzles. However, it is not attractive to make use of pronounced low capacity nozzles.

Fig. 6 corresponds to Fig. 5 with the exception that every third X-nozzle is operatively substituted by a Y-nozzle, viz. nozzles Nos. 14, 17 and 20. Hereby every sub area of the road will receive liquid from two Y-nozzles and one X-nozzle, this amounting to a dosage of 90° generally.

In Fig. 7 every third X-nozzle is kept operative while the remaining nozzles are Y-nozzles. The result is that the general dosage is now "80%".

As mentioned, it may be desirable to effect the dosage in a differential manner along the beam, and Fig. 9 illustrates that the middle portion of the area shown is generally supplied with 70% binder, while at both sides, from the nozzles 12, 13, 20 and 21, the dosage is 100%. However, because of the lateral overlapping of the binder fans the dosage will not change abruptly from 70% to 100%, since as illustrated the change will go through steps of 80% and 90%, this normally being just according to the requirements as to a non-abrupt dosage difference.

It will of course be possible to use any combination of X- and Y-nozzles for a differential dosage, e.g. even with a single different nozzle

somewhere along the beam.

The dosage outwards from the beam ends will be gradually decreasing, and since the dosage requirements are normally high along the edge of the road it may be recommendable to keep both the X- and Y-nozzles open adjacent the road side end or ends of the boom.

Obviously, many modifications will be possible within the scope of the invention, especially as far as the positioning of the nozzles is concerned. Their positions in two parallel rows just behind each other and their uniform height positions and spray angles are all optional, but the arrangement is convenient in practice both for a simple construction and for conditioning a simple control unit, as well as for an easy understanding.

The control unit may well be programmable to effect the necessary dosage changes during the work along a road, according to premeasured requirements. The operator may still have the possibility to manually actuate any desired nozzle or nozzles should the need arise. This may even be done by a radio controlled system which enables the operator to move around for better inspection of the work.

CLAIMS

1. A method of effecting dosage of a binder liquid to a road surface preparatory to the laying out of a top layer aggregate thereon, whereby the binder is applied from a row of spray nozzles on a spray boom as moved along the road in a transverse position, the spraying capacity of the nozzles being adjusted to a required dosage both generally and differentially along the spray boom, characterized in that use is made of a plurality of nozzles which are held relatively closely together and are operable, during the work, to supply the binder to the road surface in individual areas or stripes with considerable overlapping between adjacent stripes as originating from neighboring nozzles located spaced from each other in the transverse and/or longitudinal direction of the spray boom, all or many of said nozzles being of a type operable to be individually shifted on/off-wise between an open and a closed position, and that a selected number of these nozzles are caused to be closed or opened for adapting the dosage to the actual requirements.

2. A spreader device for effecting liquid dosage according to claim 1, comprising a spreader boom having a series of spray nozzles, characterized in that the nozzles are designed and provided such that the stripes of liquid as left on a road surface behind the respective neighboring nozzles will be overlapping at least to a considerable degree, and that at least most of the nozzles are of a type operable to be individually actuated on/off-wise preferably by individual remote control.

3. A device according to claim 2, characterized in that th boom is provided with two series of nozzles of high capacity and reduced capacity, respectively.

4. A device according to claim 3, characterized in that the nozzles of each series are arranged so as to output-wise overlap each other considerably.

5. A device according to claims 2—4 characterized in that the nozzles are so arranged that the said overlapping between the neighboring nozzles of each series is of the magnitude three times the distance between the neighboring nozzles.

6. A device according to claim 3, characterized in that the nozzles in the two rows are mounted direct behind each other, and that all the nozzles show a substantially uniform spreading angle and are mounted with uniform working height above the road surface.

7. A device according to claim 6, characterized in that the nozzles are designed and mounted such that the areas of fall of the binder liquid on the road from two neighboring nozzles along the spreader boom overlap each other by a length, which as seen in the transverse direction of the spreader boom amounts to a substantially full multiple of the distance between the neighboring nozzles, preferably the multiple two.

8. An apparatus according to any of the claims 2—7, characterized in that the nozzles are branched off from a common supply channel and that control means are provided for maintaining a substantially constant medium pressure in the supply channel.

9. An apparatus according to claim 8, characterized in that the nozzles are provided with individual actuator means being individually operatively connected with a control unit, and that this unit is additionally operatively connected with a positive displacement pump for supplying binder liquid to the supply channel such that the rate of binder supply is graduated according to the actual number of open nozzles and, if relevant, the numbers of open nozzles of high and reduced capacity, respectively.

10. An apparatus according to claim 6, characterized in that the nozzles are provided in the lower wall of the tubular spreading boom, and that above each of the nozzles there is mounted on the top side of the boom a control cylinder, the depending piston rod of which is shiftable between a raised inactive position and a lowered active position, in which the outer end of the piston rod closes the inner receiver opening of the associated nozzle.

11. A method according to claim 1 and substantially as herein described.

12. A device for effecting liquid dosage substantially as herein described with reference to the accompanying drawings.

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